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CLASS ANTAGONISM, EXPLOITATION AND THE LABOUR THEORY OF VALUE*

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It is a key hypothesis of Marxian historical theory that the working class will eventually emancipate itself in a process of class struggle against capitalists by establishing a socialist system without exploitation. Class struggle is regarded as resulting from a fundamental conflict of class interests which cannot be resolved within capitalist relations of production. We call a state of class relations characterised by such antagonistic interests 'class antagonism'. The paper deals with problems of the theoretical basis for class antagonism in Marxian theory. First, we will identify the set of value judgements on social relations which constitutes the Marxian concept of exploitation, and show that the Marxian assertion of class antagonism due to the exploitation of workers crucially depends on the assumption that these value judgements are accepted on the part of workers, a point seemingly unclear or, to say the least, usually not explicitly discussed in Marxian theory. Secondly, we will prove that, contrary to common belief, the assertion of class antagonism is entirely independent of the labour theory of value.

To avoid misunderstandings, we have to explain the concept of class antagonism as used in this paper in some more detail. First of all, class antagonism has to be distinguished from class struggle, which usually denotes a non-peaceful course of class actions in the pursuit of class interests. While it is meaningful to assume that class struggle presupposes conflicting interests, the reverse is, in general, not true. For instance, antagonism does not lead to struggle if some peaceful strategy yields the highest pay-off of all feasible strategies in terms of the interests assumed. So the relation between class antagonism and class struggle is complicated, and here we have nothing more to say about it. Secondly, we must be aware that the intended explanation of actual class behaviour from class interests has important implications for the concept of interests. A class can act only as a (formal or informal) coalition, which means that stability requires the coalition to further the individual interests of all its members. Therefore, class interests are to be understood as the common *individual* interests of the respective class members. Furthermore, individual interests are to be interpreted as ends which are *actually* relevant to the respective individual in choosing a particular course of action. This methodological individualism excludes functionalistic concepts of class interests in particular.

Marx characterises class antagonism as an 'unavoidable antagonism between the exploiter and the living and labouring raw material he exploits' (Marx,

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1887, p. 331). Capitalists are interested in profits, and, according to the so-called Fundamental Marxian Theorem (FMT), positive profits imply the exploitation of workers (Okishio, 1963; Morishima, 1973). Provided that this is true, the Marxian assertion of class antagonism due to exploitation is correct *if and only if* workers are vitally interested in not being exploited. This interest simply means a preference for non-exploitative social relations over exploitative ones. The preferred set of relations is determined by the applied concept of exploitation. Thus, the Marxian assertion of class antagonism crucially depends on the assumption that his concept is a constituent part of workers' preferences. This means that it has to be regarded as a set of value judgements on social relations holding among workers. It is one aim of this paper to identify these value judgements by providing a number of axioms that, first, are implied by Marxian exploitation theory and, secondly, jointly define a definite exploitation concept, able to generate the standard results of this theory.

Traditionally, Marxian exploitation theory is presented entirely in terms of the labour theory of value, so that the theoretical underpinning of class antagonism seems to stand and fall with this theory. This is one reason why for most participants in the centennial debate on the labour theory, it was Marxian class theory which was really at stake below the surface of price-theoretic issues. Meanwhile, Samuelson (1971), Morishima (1973) and Steedman (1977) have shown definitely that the labour theory makes an 'unnecessary detour' (Samuelson, 1971, p. 421) in deriving the uniform profit rate and associated relative production prices from labour values and the Marxian rate of exploitation. In spite of this, and other shortcomings, most Marxians are seemingly not prepared to give up this theory. The reason simply is that they regard it not only as an economic theory, but also as the basis of Marxian sociological theory[1], which, in substance, is Marx's class theory. They are supported by the often quoted statement of Marx that 'value is a relation between persons expressed as a relation between things' (1887, p. 74) and not, as in non-Marxian theory, just a relation between objects. So, why not make an unnecessary detour in economic theory if this detour is simultaneously the straight way towards an important sociological and historical theory? However, it is a second aim of this paper to demonstrate that the premise of this question is not true. Our investigation will show that the Marxian argument for class antagonism due to exploitation is in fact wholly independent of the labour theory.[2]

The paper proceeds as follows: Section I presents a simple model economy to which our analysis of Marxian exploitation refers. Section II offers an axiomatisation of the Marxian exploitation concept. Section III demonstrates

[1] Several Marxist and non-Marxist authors have argued explicitly that the Marxian theory of value is or, at least, might be a useful starting point for a sociological theory of capitalism, although as a price theory, it is inferior to certain non-Marxist approaches. Moreover, they have emphasised that sociological problems were much more important to Marx than price-theoretic ones. This is the view of, for instance, Petry (1916), Sweezy (1942), Baumol (1974) in his completely misunderstood critique of Samuelson (1971), and, in a sense, Bowles and Gintis (1981).

[2] Recently, Roemer (1982) has offered an interesting game-theoretic approach to exploitation which does not depend on the labour theory of value. However, his concept of exploitation is somewhat different from Marx's (and ours).

that the theoretical apparatus developed in the preceding sections is able to generate the standard results of Marxian exploitation theory, and discusses the role of some crucial axioms. Section IV provides a summary and some conclusions with respect to Marxian class theory. Finally, the Appendix extends the analysis to the cases of heterogeneous production processes of any commodity and joint production.

I. THE REFERENCE ECONOMY

For reasons of space, our investigation is confined to a pure capitalist market economy. Since our subject is not to explain how resources are allocated, productive and consumptive allocation, as well as all prices, are assumed as given.

Each production process actually carried through is of the point input-point output type, where the production period is the same for all processes and chosen as the unit of time. Each commodity is produced by one and only one firm. There is no joint production (and, hence, no fixed capital) so that each firm has only one kind of output.[1] Firm j produces the amount $b_{jj} > 0$ of commodity j $(j = 1, 2, \ldots, n)$. The output matrix is defined as $\mathbf{B} := \operatorname{diag}(b_{11}, \ldots, b_{nn})$. The matrix of produced inputs is defined as the $(n \times n)$-matrix $\mathbf{A} := (a_{ij})$, where a_{ij} denotes the input of the ith commodity in the jth firm. Mostly, it is convenient to employ the matrix of net outputs $\mathbf{D} := \mathbf{B} - \mathbf{A}$. Note that $d_{ij} \leqq 0$ if $i \neq j$. Finally, let the $(m \times n)$-matrix $\mathbf{L} := (l_{kj})$ represent the labour inputs of the various kinds in the various firms. It is assumed that each firm needs some type of labour. Thus, $\mathbf{L}$ contains no zero column. There may also be inputs of natural resources, but they need not be specified. Note that we are concerned only with production processes chosen by firms. Hence, we neither assume constant returns to scale nor the impossibility of choice of techniques.

Let $\mathbf{p}$ denote the vector of stationary spot prices of produced commodities, and $\mathbf{w}$ the vector of wage rates. All prices and wage rates are assumed positive. As a matter of convenience, the monetary equivalent of Marxian surplus value is called 'profit'. Thus profit is defined as the excess of the money value of output over the cost of produced inputs and labour power, where all quantities are valued at spot prices. Therefore, profits include, for example, returns to capital, rents and surplus profits. We assume that profits are nonnegative. If $\boldsymbol{\pi}$ denotes the vector of firm profits, we can summarise:

$$\boldsymbol{\pi}' := \mathbf{p}'\mathbf{D} - \mathbf{w}'\mathbf{L} \geqq \mathbf{0}, \mathbf{p} > \mathbf{0}, \mathbf{w} > \mathbf{0}, \mathbf{w}'\mathbf{L} > \mathbf{0}. \tag{1}$$

Prices and wages are measured in terms of the economy's total wage bill. Thus, defining $\mathbf{u}$ as the summing-up vector, the price system is normalised as follows:

$$\mathbf{w}'\mathbf{L}\mathbf{u} = 1. \tag{2}$$

[1] The Appendix extends our analysis to the cases of industries of heterogeneous firms and joint production.

Finally, it is assumed that total wages $\mathbf{w}'\mathbf{Lu}$, are spent on consumption goods. Thus, denoting the vector of workers' consumption goods $\mathbf{c}$, and taking account of (2), we obtain:

$$\mathbf{p}'\mathbf{c} = 1. \tag{3}$$

The economy described above is called the 'reference economy'. Note that, among others, it is characterised by a particular allocation in a particular period of time, particular prices and wages, and the validity of (1)–(3).

II. THE MARXIAN CONCEPT OF EXPLOITATION

In general, the agents of Marxian exploitation theory may be individuals or groups of individuals such as, for instance, the working or the capitalist class. The theory investigates the social relations of production (and exchange) under the division of labour aspect. The division of labour is brought about by transactions of 'concrete' labour times and labour products between agents. Any such transaction between two agents implies that one appropriates what is supplied by the other. According to Marx, appropriation of some concrete labour time means direct appropriation of its products.

Whether or not agents exploit each other depends on these transactions. Amounts of concrete labour are 'reduced' by means of 'reduction coefficients', usually interpreted as productivity parameters, to amounts of aggregate or 'abstract' labour, and labour products are valued by the amounts of abstract labour socially necessary for their reproduction, i.e. labour values. Any agent is defined to exploit his transaction partner if and only if the amount of abstract labour appropriated from the latter exceeds the amount supplied.

Non-exploitation, exploitation and fairness

Let us regard amounts of goods and services supplied as negative amounts appropriated. Then, the (net) quantities appropriated from somebody else can be represented by a point in a Euclidean space with a dimension equal to the number of goods and services relevant to the Marxian exploitation concept. Any such point is called an 'appropriation activity' (or, for short, 'appropriation'). The set of theoretically possible appropriations, denoted X, is termed the 'appropriation space'. Using these concepts, the Marxian non-exploitation relation can formally be defined as follows:

Postulate 1. *For the reference economy, there exists an appropriation space, X, and a subset $N \subset X$ such that, for all pairs (Y,Z) of individual or combined agents of the economy, and all transactions between them, 'Y does not exploit Z' is equivalent to 'Y's appropriation from Z belongs to N'.*

Since N is the set of all 'non-exploitative' appropriations, it is called the 'non-exploitative set'. The statement 'Y exploits Z' is defined as 'It is not true that Y does not exploit Z, but Z does not exploit Y'. If Y's appropriation from Z is $\mathbf{x}$, then Z's appropriation must be $-\mathbf{x}$, because each appropriates what the other supplies. Hence, $\mathbf{x}$ is defined as 'exploitative' if and only if $\mathbf{x} \notin N$ but $-\mathbf{x} \in N$. The corresponding 'exploitatative set' is $E := \{\mathbf{x} | \mathbf{x} \notin N, -\mathbf{x} \in N\}$.

Furthermore, the relation between Y and Z is said to be 'fair' if and only if neither one exploits the other. This is equivalent to $\mathbf{x}, -\mathbf{x} \in N$. Therefore, the 'fair set' is defined as $F := \{\mathbf{x} | \mathbf{x}, -\mathbf{x} \in N\}$.

Next, the exact relationship between the appropriation space relevant to the Marxian exploitation concept on the one hand, and the commodity space of the reference economy on the other, has to be specified. In general, there are four types of commodities: products available at the beginning and at the end of the period (respectively), natural resources available at the beginning, and labour services to be delivered during the period. In Marxian exploitation theory, products are not distinguished by the date of availability since, as is well known, the same vector of labour values is used to evaluate products of both dates. Furthermore, natural resources are altogether disregarded in the Marxian exploitation concept as they are not produced by means of labour. Thus the Marxian appropriation space can be conceptualised as follows:

Postulate 2. *The appropriation space for the reference economy is an* $(m+n)-$*dimensional Euclidean space. Each of its dimensions is assigned to a particular type of labour or product and vice versa, where labour and products are distinguished only by the respective spot markets.*

This axiom will turn out later on to be crucial from the neoclassical point of view.

According to Postulate 2, any appropriation can be regarded as an $(m+n)-$vector with the first m entries referring to labour and the last n to products. For the moment, let $\mathbf{v}$ denote an $(m+n)-$vector of reduction coefficients and labour values. Then, for any $\mathbf{x} \in X$, $\mathbf{v}'\mathbf{x}$ measures the amount of exploited labour associated with $\mathbf{x}$. Thus, Marx's exploitation concept rests on two logically distinct assumptions: First, the non-exploitative set is assumed to be of the form $N = \{\mathbf{x} | \mathbf{v}'\mathbf{x} \leqq \mathbf{O}, \mathbf{v} > \mathbf{O}\}$ implying $E = \{\mathbf{x} | \mathbf{v}'\mathbf{x} > \mathbf{O}\}$ and $F = \{\mathbf{x} | \mathbf{v}'\mathbf{x} = \mathbf{O}\}$. Secondly, the elements of $\mathbf{v}$ are identified with labour values and reduction coefficients. Both assumptions are rather special and need to be discussed in detail.

The linear structure of exploitation

The following four axioms on the non-exploitation relation will prove a necessary and sufficient foundation for the Marxian non-exploitation criterion $\mathbf{v}'\mathbf{x} \leqq 0$.

Postulate 3. *The non-exploitation relation has the following properties*:

(i) *Convexity*: *N is convex.*
(ii) *Reciprocity*: *N contains no semipositive appropriation.*
(iii) *Completeness*: *For all* $\mathbf{x} \in X$, *at least one of* $\mathbf{x}$ *and* $-\mathbf{x}$ *belongs to N.*
(iv) *Closedness*: *N is closed.*

How can properties (i)–(iv) be motivated? Provided that $\mathbf{x}^0$, $\mathbf{x}^1$ are non-exploitative, the same should reasonably be assumed for $\alpha\mathbf{x}^0$ and $(1-\alpha)\mathbf{x}^1$ if

$0 < \alpha < 1$. Since then $\alpha\mathbf{x}^0 + (1-\alpha)\mathbf{x}^1$ is made up by two non-exploitative appropriations, it should also be regarded as non-exploitative so that N should be assumed as convex.[1] Reciprocity means that non-exploitation requires anybody who takes something to give something in return.[2] Completeness states that the non-exploitation relation is defined for all transactions between any pair of agents.[3] Finally, closedness means that any appropriation which is not non-exploitative cannot be turned into a non-exploitative one by a marginal variation.

PROPOSITION 1. *There exists a vector* $\mathbf{v} > \mathbf{o}$ *such that* $N = \{\mathbf{x}|\mathbf{v}'\mathbf{x} \leqq 0\}$ *if and only if* N *satisfies* Postulate 3.

Proof. Necessity. Obviously, $N = \{\mathbf{x}|\mathbf{v}'\mathbf{x} \leqq 0\}$ and $\mathbf{v} > \mathbf{o}$ imply (i)–(iv). Sufficiency. Because of reciprocity, the origin is not an interior point of N. This and convexity of N ensure, according to a familiar separation theorem[4], the existence of a vector $\mathbf{v}$ such that $N \subset \{\mathbf{x}|\mathbf{v}'\mathbf{x} \leqq 0\}$. Moreover, completeness implies any $\mathbf{x}$ with $\mathbf{v}'\mathbf{x} < 0$ belonging to N since, owing to $\mathbf{v}(-\mathbf{x}) > 0$, $-\mathbf{x}$ is not. This, together with closedness of N, yields $N \subset \{\mathbf{x}|\mathbf{v}'\mathbf{x} \leqq 0\}$. Mutual inclusion proves $N = \{\mathbf{x}|\mathbf{v}'\mathbf{x} \leqq 0\}$. Then (ii) implies $\mathbf{v}'\mathbf{x} > 0$ for all $\mathbf{x} \geq \mathbf{o}$ This can hold true only if $\mathbf{v} > \mathbf{o}$, Q.E.D.

It is convenient to define $\mathbf{v}'\mathbf{x}$ as the 'exploitation value' of the appropriation $\mathbf{x}$. Then the elements of $\mathbf{v}$ can be characterised as (unit) exploitation values of the corresponding products or labour. It should be clear that under Postulate 3, relative exploitation values are sufficient to determine N uniquely. Hence, we are free to restrict $\mathbf{v}$ by some normalisation $\mathbf{v}'\bar{\mathbf{x}} = 1$ so that the value of any appropriation is measured in terms of the numéraire appropriation $\bar{\mathbf{x}}$. Deviating from Marx who chose $\bar{\mathbf{x}}$ to contain only one unit of 'simple' labour, we find it convenient to measure all exploitation values in terms of total labour. Taking account of the partition $\mathbf{v}' = (\boldsymbol{\rho}', \boldsymbol{\lambda}')$, where $\boldsymbol{\rho}$ is an m-vector and $\boldsymbol{\lambda}$ an n-vector, this normalisation can be written as:

$$\boldsymbol{\rho}'\mathbf{L}\mathbf{u} = 1. \tag{4}$$

The determination of exploitation values

As far as I can see, there are two rather detailed passages in Marx's work dealing with the heterogeneous labour aspect of non-exploitation. The first is to be found in his critique of Proudhon (1963, ch. 1, §2) and the second in his

[1] Contrary to what one might possibly think, the convexity postulate does not depend on any assumption about returns to scale. According to Postulate 1, N is only used to evaluate appropriations in the reference economy. As the reference economy is characterised by a particular time period and a particular productive allocation, the actual scale of production is the same for all appropriations to be evaluated. Hence, there is no reason for the shape of N to depend on the shape of the economy's production set. However, it is evident from Postulate 5 and Proposition 2 below that in case of decreasing returns, N itself depends on the actual scale of production.

[2] This is meaningful only if there are no free goods, which is ensured by (i). In case of free goods, (ii) should be replaced by the more general postulate (ii*): Any $\mathbf{x} \geq \mathbf{o}$ is fair if all its positive entries refer to free goods, otherwise $\mathbf{x} \notin N$. With (ii) replaced by (ii*), the vector $\mathbf{v}$ in Proposition 1 below has the property $\mathbf{v} \geqq \mathbf{o}$ with $v_i = 0$ if and only if i represents a free good ($i = 1, \ldots, m+n$).

[3] Completeness also implies reflexivity. All net appropriations from oneself are necessarily zero, and completeness implies the zero appropriation to belong to N.

[4] A proof can be found in Nikaido (1968, p. 28).

critique of the Gotha Programme of the German Social Democrats (1966, pp. 8–10). Both very clearly reveal the issue behind the formal reduction problem. In Marx's time, many critics of capitalism (Bray, Proudhon, Dühring and the egalitarian Ricardians, for example) argued that social equality (i.e. in our terms, general fairness) would require equal labour times to be treated as equivalents. The latter 'equalitarian' demand was criticised by Marx as entirely unrealistic and utopian. According to his view, inequality due to class relations of ownership has to be distinguished from inequality due to efficiency differentials of labour. Even under socialism, it would be necessary to reward labour according to efficiency in order to cope with the incentive problem. This position of Marx has been pointed out especially by Sen (1973, ch. IV) with reference to the critique of the Gotha Programme.

In competitive markets, the relative rewards of the different types of labour reflect the corresponding relative productivities. In accordance with this fact, Marx, in a passage against Proudhon, states with great emphasis that competition decides whether or not two different labour times are equivalent (1963, p. 53). Since he accepts the competitive evaluation in his exploitation framework, we can assume that any two bundles of labour earning the same wages count as equivalents:

POSTULATE 4. *Any appropriation with all non-labour components being zero is fair if the exchange value of the bundle of labour appropriated is zero.*

Postulate 4 obviously implies that any two kinds of labour can be substituted for each other within the fair set according to the market exchange rate which equals the corresponding relative wage. On the other hand, if Postulate 3 holds, the rate of substitution within the fair set is equal to the corresponding relative exploitation values. Hence, under Postulates 3 and 4, $\boldsymbol{\rho}$ and $\mathbf{w}$ are proportional.[1] This, together with (2) and (4), implies

$$\boldsymbol{\rho} = \mathbf{w}. \tag{5}$$

For argument's sake, interpret the elements of $\boldsymbol{\lambda}$ as labour values and those of $\boldsymbol{\rho} = \mathbf{w}$ as reduction coefficients. Then the definition of labour values as amounts of embodied abstract labour gives rise to the familiar definitional equations:

$$\boldsymbol{\lambda}'\mathbf{D} = \mathbf{w}'\mathbf{L}. \tag{6}$$

Let $\mathbf{D}_j$ and $\mathbf{L}_j$ denote the jth column of $\mathbf{D}$ and $\mathbf{L}$, respectively. The jth firm's production activity can be represented by the vector $(-\mathbf{L}_j', \mathbf{D}_j')'$. Equations (6) are equivalent to $(\mathbf{w}', \boldsymbol{\lambda}')\,(-\mathbf{L}_j', \mathbf{D}_j')' = 0$ for all j, so that Marx's exploitation concept assesses any appropriation equal to some production activity as fair. We use this implication as an axiom:

[1] Marx nearly always hesitated to state this frankly (for one exception, see (1909, p. 142)) because he wanted to avoid the impression that labour values might depend on wages, and, hence, on the price system. According to his view, relative wages correspond to relative productivities of labours but both are to be explained by some cost of reproduction theory, so that labour values can be determined independently of the price system. This line of argument fails if productivity differentials are due to natural differences of workers.

POSTULATE 5. *Let a production activity be represented by the vector of net outputs of those goods and services constituting the appropriation space characterised in* Postulate 2. *Then, any appropriation equal to a production activity actually carried through is fair.*

The axiom states that it is fair to exchange the output of a competitively viable production process, or any equal amount of the same product, for the product and labour inputs consumed in the respective process. This could be motivated as follows: The output supplier does not exploit as he only gets back the inputs actually used up to obtain the output. Moreover, these inputs are cost-minimising so that the respective output could not be obtained from fewer inputs. And the input supplier does not exploit, because he could obtain the products made available to him at the same cost from a production activity carried out all by himself. According to Locke's famous argument, he could rightly appropriate the fruits of his own labour (1690, ch. v).

However, in conjunction with Postulate 2, Postulate 5 has two crucial implications. First of all, fairness requires no compensation for inputs of natural resources as, according to Postulate 2, these resources do not appear in appropriations. Marx regards production as an exchange between man and Nature (1887, p. 177 *et seq*). Nature provides its resources to man for free, and man has to supply labour and produced inputs only for the transformation of primary goods into products. Therefore, one might demand that nobody should be allowed to gain an advantage over others by monopolising natural resources. This is ensured by the postulates adopted. The second crucial implication is that a spot exchange of any output for the inputs required for its reproduction is regarded as fair, although productive capitalists have to 'wait' until their inputs are transformed into outputs. Hence, fairness requires no compensation for 'waiting'. Formally, this is mainly due to the implication of Postulate 2 that the date of availability is irrelevant to the exploitation concept. Marx seems to hold, first, that ability and willingness to 'wait' mainly depend on personal wealth, and secondly, that wealth ownership is due to favourable initial conditions and the working of the capitalist system, and does not correspond to any *personal* characteristics interpretable as meritorious. In this case, one may find that 'waiting' deserves no compensation.

Evidently, Postulate 5 implies exploitation values of products to satisfy (6). We can show now that Postulates 1–5 constitute a well-defined exploitation concept:

PROPOSITION 2. *Let the non-exploitation relation satisfy* Postulate 3 *implying the existence of some vector of positive exploitation values,* $\mathbf{v}$, *such that* $N = \{\mathbf{x} | \mathbf{v}'\mathbf{x} \leqq 0\}$, *and let* $\mathbf{v}$ *be normalised by* (4). *Then, for the reference economy, the only such vector compatible with* Postulates 4 *and* 5 *is* $(\mathbf{w}', \mathbf{w}'\mathbf{L}\mathbf{D}^{-1})'$.

Proof. We have already shown that Postulate 4 and (4) imply $\boldsymbol{\rho} = \mathbf{w} > \mathbf{o}$. It remains to prove that, for the given $\mathbf{D}$ and $\mathbf{w}'\mathbf{L}$ of our economy, (6) solves for a strictly positive $\boldsymbol{\lambda}' = \mathbf{w}'\mathbf{L}\mathbf{D}^{-1}$. Inequalities (1) imply $\mathbf{p}'\mathbf{D} \geqq \mathbf{w}'\mathbf{L} > \mathbf{o}$. Thus $\mathbf{D}$ is profitable and, consequently, nonnegatively invertible.[1] Hence,

[1] A proof can be found in Nikaido (1968, p. 95).

$\boldsymbol{\lambda}' = \mathbf{w}'\mathbf{L}\mathbf{D}^{-1}$. This $\boldsymbol{\lambda}$ is strictly positive because, owing to invertibility, $\mathbf{D}^{-1}$ contains no zero column and $\mathbf{w}'\mathbf{L}$ is strictly positive, Q.E.D.

Although exploitation values and labour values are conceptually entirely different, (6) obviously allows us to interpret exploitation values of products as amounts of embodied 'abstract' labour. The point is that the postulates stated provide a logical basis for Marx's use of labour values as exploitation values. However, the labour value interpretation is rather limited. It will be shown in the Appendix that, under joint production, it ceases to be sensible. In any case, in reconstructing the Marxian concept of exploitation, we have made no use whatsoever of the labour *theory* of value. It thus depends in no way on this theory.

III. THE RELATION BETWEEN WORKERS AND CAPITALISTS

The Fundamental Marxian Theorem

Marxian theory asserts that capitalism is a system of exploitation like, for instance, feudalism or slavery. As opposed to the latter two, exploitation under capitalism is not obvious, but rather, obscured by a general ideology of equality, rooted deeply in the system of voluntary exchange. Hence, it has to be proved that workers are systematically exploited.

Workers are exploited if and only if the value of the capitalist appropriation activity, $\mathbf{x}^C$, is positive. Capitalists appropriate workers' concrete labour times, represented by the vector $\mathbf{Lu}$, and dispose of the workers' means of subsistence, represented by $\mathbf{c}$. We thus obtain $\mathbf{v}'\mathbf{x}^C = \boldsymbol{\rho}'\mathbf{Lu} - \boldsymbol{\lambda}'\mathbf{c}$. Taking account of $\boldsymbol{\rho}'\mathbf{Lu} = 1$, we can write

$$\mathbf{v}'\mathbf{x}^C = 1 - \boldsymbol{\lambda}'\mathbf{c}. \tag{7}$$

A firm is called 'basic' if it produces commodities that are required directly (as means of subsistence) or indirectly (as means of production) to reproduce the labour force. To state exactly what this means, define:

$$\mathbf{q} := \mathbf{D}^{-1}\mathbf{c}. \tag{8}$$

Because of $\mathbf{D}^{-1} \geqq \mathbf{o}$, $\mathbf{c} \geq \mathbf{o}$ and the nonsingularity of $\mathbf{D}^{-1}$, $\mathbf{q}$ must be semi-positive. Now any firm j is called basic if and only if $q_j > 0$. This makes sense because $\mathbf{q}$ can be interpreted as that vector of firm activity levels yielding, under hypothetically constant returns to scale, a vector of net outputs, $\mathbf{Dq}$, equal to $\mathbf{c}$.

PROPOSITION 3 (FMT). *If* Postulates 1–5 *are valid, the following assertions hold for the reference economy*:

(i) *Capitalists exploit workers if and only if the basic sector's profits are positive.*[1]

(ii) *The relation between workers and capitalists is fair if and only if the basic sector's profits are zero.*

[1] It is worthwhile noting that our version of the FMT slightly differs from Morishima's standard version (1973, p. 53). He proves that the *possibility* of positive profits in each and every industry is necessary and sufficient for workers to be exploited by capitalists. This is motivated by his interpretation of the FMT as the Marxian substitute for the Hawkins-Simon conditions.

Proof. Consider $\boldsymbol{\pi}'\mathbf{q} = (\mathbf{p}'\mathbf{D} - \mathbf{w}'\mathbf{L})'\mathbf{D}^{-1}\mathbf{c}$. Because of $\mathbf{p}'\mathbf{c} = 1$ and $\mathbf{w}'\mathbf{L} = \boldsymbol{\lambda}'\mathbf{D}$, we obtain $\boldsymbol{\pi}'\mathbf{q} = 1 - \boldsymbol{\lambda}'\mathbf{c} = \mathbf{v}'\mathbf{x}^C$. Owing to $\boldsymbol{\pi} \geqq \mathbf{o}$ and $\mathbf{q} \geq \mathbf{o}$, one can conclude immediately that a positive (zero) $\boldsymbol{\pi}'\mathbf{q}$ is equivalent to positive (zero) profits of the basic sector Q.E.D.

Exploitation at the point of production or at the point of exchange?

According to Marx, the capitalist appropriation, $\mathbf{x}^C$, can be regarded as resulting from two successive transactions between workers and capitalists. The first takes place in the market, where workers trade the right to use their labour power to capitalists for consumption goods in return. The second is carried through at the work place, where capitalists appropriate the workers' labour by putting them to work, and at the same time lose the right to use the workers' labour power. Aggregating both transactions, one obtains a transfer of labour from workers to capitalists and a transfer of consumption goods from capitalists to workers.

As is well known, Marx argues that the market transaction is fair, and, hence, all exploitation occurs at the work place. He treats labour power as a produced commodity which is obtained from the goods consumed by workers. Thus, the labour value of labour power equals by definition the labour value of the commodity bundle consumed so that, provided workers do not save, equivalents are exchanged in the market. In our framework, this argument can be represented as follows: The appropriation space can be extended to include labour power. Marx's argument implicitly assumes that Postulate 5 is valid also for the appropriation and production of labour power. Conversely, starting from Postulate 5, one obtains that the exploitation value of labour power equals the exploitation value of the subsistence bundle. Thus, if all wages are consumed, the market transaction between workers and capitalists is found to be fair. However, Marx's argument for the fairness of market exchange is not quite satisfactory. The point is that he treats labour power and other produced commodities completely alike, although there are differences which might require a different treatment.

Ordinary commodities are produced subject to cost minimisation. In combination with Postulate 5, this means that what one is entitled to get in return for a trade of these commodities is minimised by the objective laws of competition. The laws governing the production of labour power are substantially different. To make this clear, we may ask as to how workers ought to behave that this be not the case. Clearly, for any given wage, they should minimise consumption (i.e. maximise accumulation) subject to the constraint that their labour power is reproduced. Everyone should agree that this is absurd as a description of real behaviour. In fact, there are motives for consumption completely unrelated to the reproduction of labour power. Otherwise, one could hardly explain why so many goods are consumed which are known to ruin rather than to reproduce the ability to work. Therefore, in general, workers' consumption cannot entirely be regarded as necessary for the reproduction of labour power, at least not in the same sense as goods consumed in ordinary production processes are necessary inputs. Hence, from the capitalist point of

view, one could reasonably object to Marx's assertion of market fairness that workers should not be allowed to make every wage a fair one just by spending it entirely on consumption goods for reasons completely unrelated to the reproduction of their work capacity.

On the other hand, if workers save part of their income, they are assumed to exploit capitalists in the market. Workers could (and, I think, would) reasonably object that they consider it absurd to assess the question of wage fairness just by comparing the real wage with some reference standard of a physical or cultural subsistence level. It is one thing to agree that ordinary products should exchange for the inputs necessary for their reproduction, and quite another thing to agree that the same principle should be applied to labour power. In contrast to sellers of ordinary products, sellers of labour power are personally involved when buyers put it to use, and this difference will affect the way they think about wage fairness. It is very unlikely that they will judge the market result independently of what will happen to them at the work place. Therefore, workers will tend to base judgements on fairness or exploitation on direct comparisons of what they get in the market with the labour they have to do at the work place. This means that the Marxian procedure of first comparing wages with some subsistence standard, and then the subsistence standard with the amount of labour done, will be irrelevant to them. In this case, it is not meaningful to separate exploitation in the market from exploitation at the work place, because this would require us to introduce standards not likely to be approved by some relevant group of agents. Thus, Marx's argument that all exploitation occurs in the sphere of production would seem to be questionable.

Neoclassical modifications of the exploitation concept

In order to demonstrate which postulates are crucial to a neoclassical economist who believes in the fairness of competitive markets, we modify the Marxian exploitation concept successively, so that the class relation becomes fair if only all markets are competitive. Firstly, he or she will reject Postulate 2, because it makes any forward exchange of amounts of the same commodity an exploitative transaction if the own rate of interest is positive. Let us, therefore, change Postulate 2 such that products are also distinguished by the date of availability. Since there are two dates for each product, namely, beginning and end of the period, the number of unknown product exploitation values doubles from n to $2n$. Postulate 5 is thus no longer sufficient to determine these values as it only induces n equations. Additionally, let us adopt the 'neoclassical' postulate that it is fair, for any particular product, to exchange one unit to be delivered today for $1+r$ units to be delivered tomorrow, where r denotes the market rate of interest. This means that a compensation for time preference, risk, etc does not violate fairness. Hence, if the n-vector of exploitation values relating to today's products is again denoted $\boldsymbol{\lambda}$, the corresponding vector relating to tomorrow's products is the discounted $\boldsymbol{\lambda}$, $\boldsymbol{\lambda}(1+r)^{-1}$. Then, defining

$$\mathbf{D}^* := (1+r)^{-1}\mathbf{B} - \mathbf{A}, \tag{9}$$

we can conclude from Postulate 5 that

$$\boldsymbol{\lambda}'\mathbf{D}^* = \mathbf{w}'\mathbf{L}. \tag{10}$$

From this, it is clear that if in (1), (6) and (8), $\mathbf{D}$ is reinterpreted as $\mathbf{D}^*$, the correspondingly reinterpreted Fundamental Theorem remains valid.[1] The profit vector is now defined as

$$\boldsymbol{\pi}^{*\prime} := \mathbf{p}'(1+r)^{-1}\mathbf{B} - \mathbf{p}'\mathbf{A} - \mathbf{w}'\mathbf{L}, \tag{11}$$

which means that only property incomes exceeding interest returns on capital invested in produced means of production and labour power count as profits. Thus, returns to capital are now compatible with a fair class relation, and exploitation coincides with the existence of rents and all kinds of surplus profits.

Secondly, our neoclassical economist will reject Postulate 2, because it makes any market exchange of a natural resource for a product or a concrete labour time an exploitative transaction. This is due to the fact that natural resources are not represented in appropriation vectors. Let us, therefore, modify Postulate 2 such that transactions of natural resources (or their services) are also represented in appropriations, and let us postulate that the exploitation values of these resources are equal to their respective competitive unit rents. This means that natural resources are treated the same way as the various kinds of labour. Hence, we can add a rent vector to the right-hand side of (10) and subtract the same vector from the right-hand side of (11). It is clear, then, that exploitation of workers is now equivalent to positive surplus profits such as, for instance, monopoly profits, which means that competitive rents also have become compatible with a fair class relation. This presumably is the exploitation concept representing neoclassical values on social relations in the economic sphere.

Thus, only the postulated appropriation space is crucial. A discussion of the Marxian concept versus the neoclassical would raise very complicated problems of political philosophy as well as economic theory, and is far beyond the scope of our investigation.

IV. SUMMARY AND CONCLUSIONS

First, we constructed an axiomatic basis for the Marxian exploitation concept. This axiomatic basis also covers the traditionally thorny cases of heterogeneous labour, joint production and heterogeneous production processes of any commodity (where the last two are dealt with in the Appendix). It consists of a well-defined set of postulates, each of which expresses, in the form of a general principle, a particular value judgement on social relations. Furthermore, it has been shown that the exploitation concept generated by the various postulates is sufficient to prove the so-called Fundamental Theorem of Marxian exploitation theory, and the role of some crucial postulates in this proof has been examined in detail.

Secondly, our analysis points to a severe problem in Marxian class theory. Taken for granted that workers are systematically exploited and that capitalists

[1] The switch from $\mathbf{D}$ to $\mathbf{D}^*$ leaves the basic sector unchanged. It is easily shown that the sign patterns of $\mathbf{q}^* := \mathbf{D}^{*-1}\mathbf{c}$ and $\mathbf{q}$ are the same.

are vitally interested in positive profits, Marx's assertion of antagonistic class interests due to exploitation is valid if and only if workers actually approve the value judgements postulated. Whether this condition is met in some meaningful sense, is, at least for a number of capitalist societies, neither evident from actual working class behaviour, nor from trade union or party ideology. Therefore, it is highly important to Marxists to have at least a theory of interest formation providing a detailed reasoning as to why workers are, or in the course of time become, vitally interested in Marixan non-exploitation. In particular, such a theory should address itself to the following questions: Why is general non-exploitation in the Marxian sense the historically relevant concept of social equality? Why not, for example, perfect competition in a capitalist system, or Rawlsian justice? Are there working-class interests competing with non-exploitation? If so, what is their relative importance? I think it is fair to say that a coherent theory answering these questions is far from existing. Apart from apparent theoretical difficulties, its development has been kept back also by an obvious tendency in Marxian theory, dating back to Marx himself, to underestimate the role of subjectivity. This has to be overcome, otherwise, one will never escape *ad hoc* assumptions in explaining actual working-class behaviour.

Finally, we can conclude from our analysis that the Marxian theory of exploitation and the labour theory of value are entirely independent. The various postulates have been shown to induce a linear structure of exploitation and, thereby, the exploitation value concept, and to make, in special cases, exploitation values of products equal to labour values. This means that the particular way in which labour values are used in the Marxian concept of exploitation is exclusively due to the assumption of particular value judgements regarding social relations, and not at all to the labour theory of value, because none of its propositions are employed in any of the postulates. Now it might be argued that, owing to the generally valid dependence of people's value judgements on their perception and explanation of real world phenomena, the labour theory could indirectly support the value standards postulated. However, I cannot see how it could lend support to any of the postulates. It seems well possible either to agree or disagree with any of the postulates, regardless of what one may think about the labour theory of value. Since the latter has no function in Marxian class theory and, moreover, is an inferior price theory, Marxists should abandon it once and for all.

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APPENDIX

Industries

The first step is to allow for any commodity to be supplied by more than one firm. Obviously, this implies that the number of firms will, in general, exceed the number of commodities. This leads to a particular difficulty. If each unit of output of some commodity were assigned the same exploitation value, regardless of the firm supplying the respective unit, the number of equations

induced by Postulate 5 would exceed the number of unknown exploitation values of products. Hence, except by chance, a solution would not exist. In order to ensure the existence of labour values, Marx had to overcome the same formal problem. He simply treats different firms' outputs of a commodity as different products, and assigns 'individual' labour values to firm-specific products (as opposed to 'social' labour values relating to commodities) (1909, pp. 178–84; 1968, pp. 203–6, 263–6). Since Marx employs labour values as exploitation values, we can state:

POSTULATE 1*. *Postulate 2 is modified in so far as products are also distinguished by the firms supplying them.*

According to the logic of Postulate 5, it is fair to exchange any output for the inputs required for its reproduction by means of a competitively viable technique. If exploitation values compatible with this logic cease to exist just because a commodity is produced by different competitively viable techniques, it is reasonable to treat different firms' outputs of this commodity as different products. Employing this product concept, we again have as many products as firms so that equations (6) can be reinterpreted as restrictions on 'individual' exploitation values. As a matter of convenience (6) is restated as:

$$\lambda_j b_{jj} - \Sigma_i \lambda_j a_{ij} = \mathbf{w}'\mathbf{L}_j \quad (\text{all } j). \tag{12}$$

Obviously, the number of equations matches the number of unknown individual values. But now we face another problem. From the assumed productive allocation, we know the amount of input of the gth commodity in the jth firm, but we do not know how this amount is composed of the various firm-specific products. Thus, the a_{ij} have to be regarded as unknowns. This means that (12) alone is not sufficient to determine individual values. The following assumption will remove this indeterminacy:

POSTULATE 6. *For any commodity and any firm-specific product, the share of the firm-specific product in any amount of the commodity actually allocated to production or consumption is equal to the share of the respective firm's output in the total output of the respective commodity.*

In order to motivate Postulate 6, suppose differing individual values of some commodity and, with respect to the amounts traded for the purpose of productive or consumptive allocation, varying proportions of firm-specific products making up these amounts. Then exploitation values of equal amounts of the commodity would usually be different. Thus, two appropriations regarded as identical from the viewpoint of markets might be valued differently in the context of exploitation theory. And it might well happen that one is assessed as exploitative and the other as non-exploitative. Hence, whether somebody exploits or is exploited would not only depend on the amounts of economically identical commodities appropriated, but also on the composition of these amounts. Since markets do not provide any information about composition of economically identical commodities, this should be regarded as discriminating. Postulate 6 precludes discrimination by treating all traded amounts of a commodity as if they were identically composed. Now, the product quantities

available for allocational purposes at the beginning of the period are the outputs of the last period. As we have no information about the history of the economy, it seems acceptable to postulate that the relative weight of a firm-specific product in a commodity composition corresponds to the relative weight of the respective firm's current output in current total output of the respective commodity.

Now all individual values can be determined. Let I_g denote the set of all firms producing the gth commodity so that I_g can be called the gth industry. According to Postulate 6, for any firm j, the input supplied by firm i is proportional to the ith firm's output:

$$a_{ij} = \frac{\sum_{s \in I_g} a_{sj}}{\sum_{s \in I_g} b_{ss}} b_{ii} \quad (\text{all } i \in I_g, g \text{ and } j). \tag{13}$$

Since $\Sigma_{s \in I_g} a_{sj}$, the jth firm's input of commodity g, is known for all firms and commodities, (13) determines all firm-specific inputs a_{ij}. Then (12) and (13) determine all individual values.[1] Evidently, the formal apparatus of Sections I–III can be reinterpreted appropriately so that, if Postulate 1* and 6 are valid, all results extend to the case that any commodity is produced by many firms using different techniques.

We could leave it at that but, however, it is possible to derive a further result on aggregation. According to Postulate 6, each unit of a particular commodity has the same composition. Thus, for the purpose of exploitation theory, it is sufficient to know the values of composite commodities or, employing Marx's terminology, 'social' values. Taking account of the postulated composition, the social value of the gth commodity is:

$$\bar{\lambda}_g = \frac{\sum_{i \in I_g} \lambda_i b_{ii}}{\sum_{s \in I_g} b_{ss}} \quad (\text{all } g). \tag{14}$$

This corresponds to Marx's statement that the social value 'is to be viewed as the average value of commodities produced in a single sphere' (1909, p. 178). On the other hand, Marx argues that 'the value of each individual commodity in a particular sphere of production is determined by the *total mass of social labour-time* required by the *total mass of the commodities of this particular sphere of social production*' (1968, pp. 205–6; Marx's emphasis). If this holds true, one can start right from the industry level to determine social values without calculating individual values first. Indeed, it can be shown that consistent aggregation is possible if Postulate 6 is assumed to be valid.

Multiplying (13) by λ_i, adding up the resulting equations relating to $i \in I_g$ and, finally, substituting (14), we obtain:

$$\sum_{i \in I_g} \lambda_i a_{ij} = \bar{\lambda}_g \sum_{i \in I_g} a_{ij} \quad (\text{all } g \text{ and } j). \tag{15}$$

[1] A formally equivalent definition of individual values is used by Flaschel (1979). Our results on aggregation (to be derived subsequently) can also be found in Flaschel (1979), although he does not state all of them explicitly. But in contrast to this paper, he is concerned with the definition of labour values.

Define now:

$$\bar{b}_{hh} := \sum_{j \in I_h} b_{jj} \quad (\text{all } h), \tag{16}$$

$$\bar{a}_{gh} := \sum_{i \in I_g} \sum_{j \in I_h} a_{ij} \quad (\text{all } g \text{ and } h), \tag{17}$$

$$\bar{\mathbf{L}}_h := \sum_{j \in I_h} \mathbf{L}_j \quad (\text{all } h). \tag{18}$$

Aggregation of all individual value equations in (12) relating to firms $j \in I_h$ and successive substitution of (14)–(18) yields

$$\bar{\lambda}_h \bar{b}_{hh} - \Sigma_g \bar{\lambda}_g \bar{a}_{gh} = \mathbf{w}' \bar{\mathbf{L}}_h \quad (\text{all } h). \tag{19}$$

Hence, Postulate 6 allows us to aggregate the individual value equations (12) into the social value equations (19). This means that Postulate 5 also holds for production activities of industries if commodities are composed according to Postulate 6. From this it is clear that all results of Sections II and III continue to hold if in Section I firms are reinterpreted as industries.

Joint production

Finally, joint production is admitted. Analogously to (12), it is possible to state value equations relating to firms. As before, these equations spring from Postulate 5 and constrain individual values. Under joint production proper, there are more firm-specific products and, consequently, more individual values than firms, because at least one firm has more than one kind of output. Hence, even if Postulate 6 is assumed to hold, the system of value equations has at least one degree of freedom, so that individual values cannot be determined uniquely.

Just as before under Postulate 6, consistent aggregation is possible. The formal procedure is analogous to that of single production and need not be repeated here. However, some remarks are in due course. From the derivation of equations (19), it can be seen that all firms supplying the same commodity must belong to the same industry (because otherwise substitution of (14) would not be possible). If then, for instance, some firm jointly produces two commodities, all firms producing any of these two have to be aggregated. This example gives rise to the following generalised aggregation rule: Two firms belong to the same industry if and only if they can be connected by a chain of firms such that any two firms of the chain linked directly have at least one kind of output in common. The binary relation 'connectedness' is reflexive, symmetric and transitive and, hence, an equivalence relation. It partitions the set of firms into disjoint equivalence classes called industries. Let P_h represent the set of commodities supplied by the hth industry. Since any two distinct industries cannot produce the same commodity whatsoever, P_h and P_t are disjoint if $h \neq t$. Under the assumption that each commodity is produced by some firm, the union of all P_h comprises all commodities.

If $\bar{b}_{gh}$ denotes the amount of the gth commodity produced by the hth industry, the (social) value equations relating to industries can be stated as follows:

$$\sum_{g \in P_h} \bar{\lambda}_g \bar{b}_{gh} - \sum_{t} \sum_{g \in P_t} \bar{\lambda}_g \bar{a}_{gh} = \mathbf{w}' \bar{\mathbf{L}}_h \quad (\text{all } h). \tag{20}$$

Since, under joint production, some industry produces more than one commodity, the number of industries falls short of the number of commodities. This means that Postulates 5 and 6 are no longer sufficient to determine unique social values. This indeterminacy is removed by:

POSTULATE 7. *For any industry, the relative exploitation values of its outputs are equal to the respective relative prices.*

What is the rationale of this axiom? Consider an economy with only one production process yielding two kinds of output. Assume net outputs to be unity so that (20) degenerates into $\lambda_1+\lambda_2 = 1$. Now, if some appropriation is fair, this property should not be destroyed by appropriating more of some free product, because everybody's demand for this commodity can be satiated at zero cost. Therefore, if the first commodity were free, its exploitation value should be regarded as zero so that $(\lambda_1, \lambda_2) = (0,1)$. Alternatively, if the second commodity were free, $(\lambda_1, \lambda_2) = (1, 0)$ should hold. Thus, values of joint products should depend on prices, i.e. on demand conditions and, hence, on preferences! The simplest assumption is that the values of joint products are proportional to the respective prices, implying relative values to be equal to relative prices. This means that for any two joint products, the rate of substitution within the fair set corresponds to the market exchange rate.

Owing to Postulate 7, there are Λ_h such that:

$$\bar{\lambda}_g = \Lambda_h p_g \quad (\text{all } g \in P_h \text{ and } h).^1 \tag{21}$$

Furthermore, it is convenient to introduce the following notation:

$$B_{hh} := \sum_{g \in P_h} p_g \bar{b}_{gh} \quad (\text{all } h), \tag{22}$$

$$A_{th} := \sum_{g \in P_t} p_g \bar{a}_{gh} \quad (\text{all } t \text{ and } h). \tag{23}$$

Substituting (21)–(23) into (20), we obtain

$$\Lambda_h B_{hh} - \Sigma_t \Lambda_t A_{th} = \mathbf{w}'\bar{\mathbf{L}}_h \quad (\text{all } h). \tag{24}$$

Thus Λ_h can be interpreted as the exploitation value of an aggregate commodity consisting of the hth industry's joint products, which are aggregated by means of prices. Equations (24) show that, under Postulates 6 and 7, Postulate 5 can be reinterpreted to hold for aggregate commodities and industries. From this it is immediate that all results of Sections II and III continue to hold if in Section I commodities are interpreted as aggregate commodities and firms as industries.

Finally, it may be noted that in a purely formal sense, exploitation values of of aggregate commodities can again be interpreted as labour values. But these labour values have hardly anything in common with amounts of labour necessary to reproduce the respective commodities, because they depend on relative prices and, hence, on demand conditions (preferences, for instance). This is due to the fact that the amounts of aggregate commodities depend on

[1] The same formal rule is applied on the firm level by Flaschel (1977) in order to determine individual labour values in the case of joint production.

relative prices, because they are employed as aggregators. For our purpose, the dependence of exploitation values on prices does not matter since we do not aim to explain prices.[1]

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[1] In the case of joint production, a satisfactory exploitation concept based on labour values seems not even to be available. Morishima's 'true' value concept (1974; Morishima and Catephores, 1978, ch. 2), the only meaningful generalisation of the labour value concept to joint production, leads to an unacceptable exploitation concept. As Okishio (1976) has pointed out, a zero rate of exploitation is well compatible with positive profits in the basic sector, and the profit share in national income may take any value smaller than one. The reason for this is that Morishima's linear programming problem determining the true value of the workers' subsistence bundle assigns zero shadow values to all luxuries produced jointly with necessities, although their prices are prohibitive to workers' demand.